Attachment to item number 5.1 -

Flood Hazard Report

Traffic Impact Assessment

15th November 2022
FE_23112

33 Dubs and Co Drive, Sorell
FLOOD HAZARD REPORT

Prepared for: Julfan Pty Ltd

flussig ENGINEERS

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Document Information

Title	*Client*	*Document Number*	*Project Manager*
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Document Initial Revision

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Rev No.	Description	Prepared by	Authorised by	Date

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1. Introduction

Flüssig Engineers has been engaged by **Julfan Pty Ltd** to undertake a site-specific Flood Hazard Report for the development at number 33 Dubs and Co Drive, Sorell in the **Sorell Council** municipality. The purpose of this report is to determine the flood characteristics on the existing and post-development hazard scenarios for the 1% AEP plus climate change, for the purpose of development.

1.1 Development

The proposed development is a multi-unit development involving a two-storey building, raised driveway entrance and a protected storage level entrance. The proposed hardstand covers approximately 1,200 m^2 of the 986 m^2 lot. The site is currently vacant.

1.2 Objectives and Scope

This report is in response to a request for further information under C12.0 Flood Prone Areas Hazard Code under the Tasmanian Planning Scheme 2021 (TPS 2021). The objectives of this study are:

- Provide an assessment of the site's flood characteristics under the combined 1% AEP plus climate change (CC) scenario.
- Provide comparison of flooding for post-development against acceptable solution and performance criteria.
- Provide flood mitigation recommendations for a potential future development, where appropriate.

1.3 Limitations

This study is limited to the objectives of the engagement by the clients, the availability and reliability of data, and including the following:

- The flood model is limited to a 1% AEP + CC worst case temporal design storm.
- All parameters have been derived from best practice manuals and available relevant studies (if applicable) in the area.
- All provided data by the client or government bodies for the purpose of this study is deemed fit for purpose and has not been checked for accuracy.
- The study is to determine the effects of the new development on flooding behaviour and should not be used as a full flood study outside the specified area without further assessment.

1.4 Relevant Planning Scheme Requirements

This report addresses the Tasmanian Planning Scheme code C12.5.1 and C12.6.1 of the Inundation Prone Areas Code of which the objective is to ensure that risk from riverine, watercourse or inland flooding is appropriately managed and takes into account the use of the buildings. Specific details of this code and how this report addresses these requirements is shown in Table 5 and Table 6.

2. Model Build

2.1 Overview of Catchment

The contributing catchment for 33 Dubs and Co Drive, Sorell is approximately 8 ha stretching from the peak at Horizon Drive to the outlet at the development site with an average slope of 7.6%.

The land use of the catchment is General Residential, with the specific site being listed as General Business.

Figure 1 below outlines the approximate contributing catchment for the site at 33 Dubs and Co Drive.

Figure 1. Contributing Catchment, 33 Dubs and Co Drive, Sorell

2.2 Hydrology

The following Table 1 states the adopted hydrological parameters for the RAFTS catchment, as per best practice guidelines.

Table 1. Parameters for RAFTS catchment

Catchment Area (ha)	Initial Loss Perv/imp (mm)	Continuing Loss Perv/imp (mm/hr)	Manning's N pervious	Manning's N impervious	Non-linearity factor
8	18/1	2.5/0.0	0.045	0.02	-0.285

2.2.1 Design Rainfall Events

Figure 2 shows the box and whisker output of the model run. The model shows that the 1% AEP 10-min storm temporal pattern 5 was the worst-case median storm. Therefore, this storm event was used within the hydraulic model.

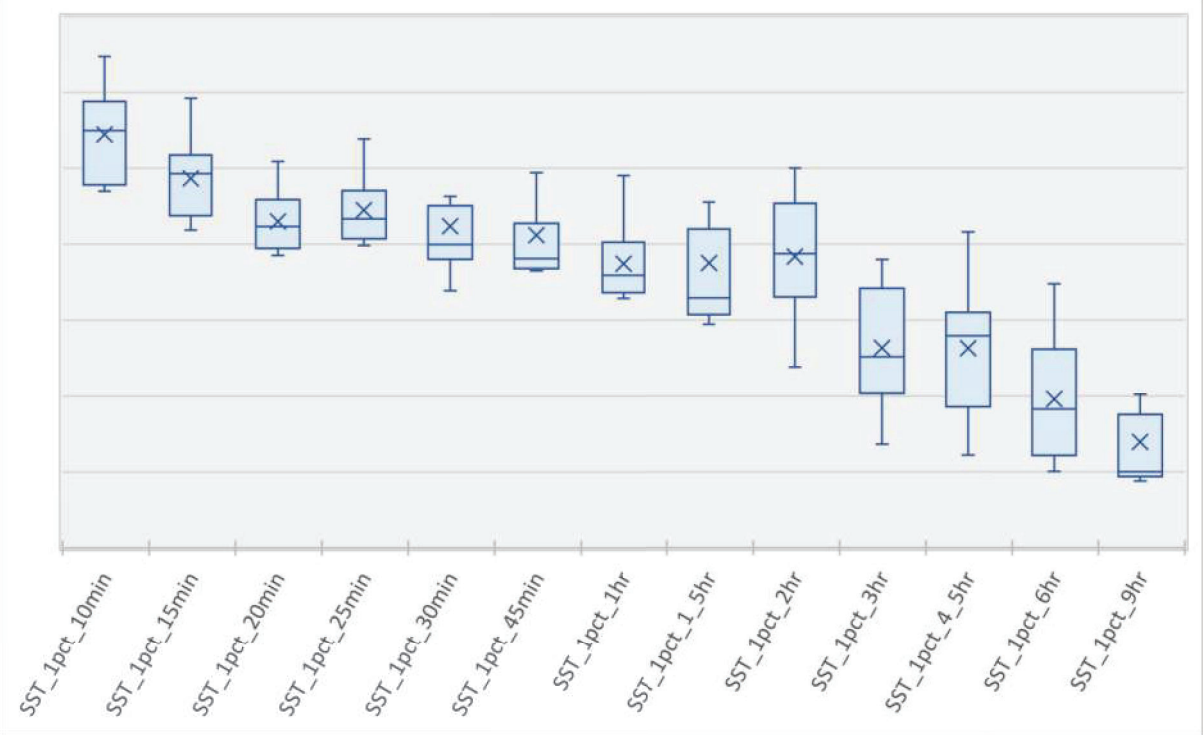

Figure 2. 1% AEP Flood Event Model, Box and Whisker Plot

2.2.2 Climate Change

As per ARR 2019 Guidelines, for an increase in rainfall due to climate change at 2100, it is recommended the use of RCP 8.5. However, ARR 2019 recommends that this figure be used in lieu of more local data being available.

The base scenario of the Climate Futures Tasmania (2010) study was revised following the ARR 2019 Australasia Climate Change study (undertaken by the University of Tasmania), resulting in the original increase in rainfall being reduced to 14.6% in cooler climates (Southern Tasmania). Table 2 shows the ARR 8.5 increased that has been adopted by Sorell Council and therefore used within the model.

Table 2. Climate Change Increases

Catchment	CFT increase @ 2100	ARR 8.5 increase @ 2100
Sorell	14.6%	16.3%

2.2.3 Calibration/Validation

This catchment has no stream gauge to calibrate the model against a real-world storm event. Similarly, there is little historical information available, and limited available past flood analysis undertaken to validate against the flows obtained in the model.

2.3 Hydraulics

2.3.1 Survey

The 2D surface model was taken from a combination of Greater Hobart LiDAR 2013 (Geoscience Australia) to create a 1m cell size DEM. For the purposes of this report, 1m cells are enough to capture accurate flow paths. The DEM with hill shading can be seen below (Figure 3).

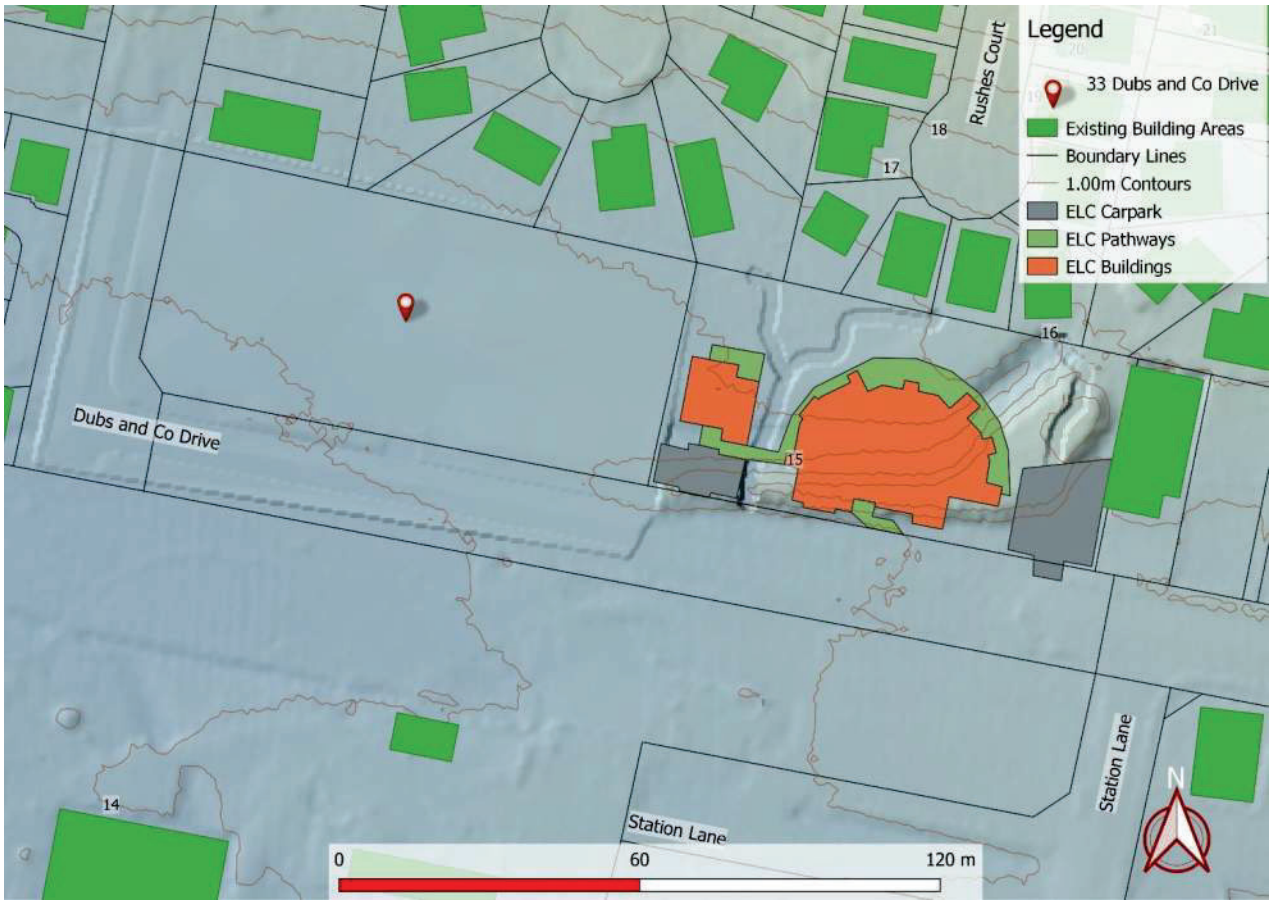

Figure 3. 1m DEM (Hill shade) of Lot Area

2.3.2 Roughness (Manning's n)

Roughness values for this model were derived from the ARR 2019 Guidelines. The Manning's values are listed in Table 3.

Table 3. Manning's Coefficients (ARR 2019)

Land Use	Roads	Open Channel	Rural	Residential	Parks	Buildings	Piped Infrastructure
Manning's n	0.018	0.035	0.04	0.045	0.05	0.3	0.013

2.3.3 Walls

Wall structures were included as base linear structures (walls) within the 2D model. The wall was set at 1.8 m off the ground level as per the design.

2.3.4 Buildings

Buildings were represented as mesh polygons with a high Manning's n value within the model. Buildings with unknown floor levels were set with a minimum 300mm above ground.

Proposed structures, including floors and driveway, were set as shown on Architectural Drawing "Sorell Development_ Conceptual Plan".

3. Model Results

The result of 1% AEP + CC were run through the pre-development and post-development model scenarios to compare the changes to flooding onsite and to surrounding properties. It can be seen from the pre-development model runs (Figure 4), that there is a small ingress of flood water on the eastern lot boundary with the early learning centre. On this boundary there is a maximum depth of <0.084 m and velocity of <0.136 m/s in the pre-development scenario.

Figure 5 shows the effect that the inclusion of the proposed development has on the overland flood flow. It can be seen that construction of the proposed building would have a negligible impact on the overland flood path, with the minimal flow from a 1% AEP storm event continuing in a westerly direction across the driveway/ carpark and discharging on the north-western boundary to Dubs and Co Drive. This has little impact on the depth at the lot boundary, with the post-development model only increasing minimally by 0.01 m, and the velocity increasing to 0.173 m/s.

Figure 4. Pre-Development 1% AEP + CC Depth

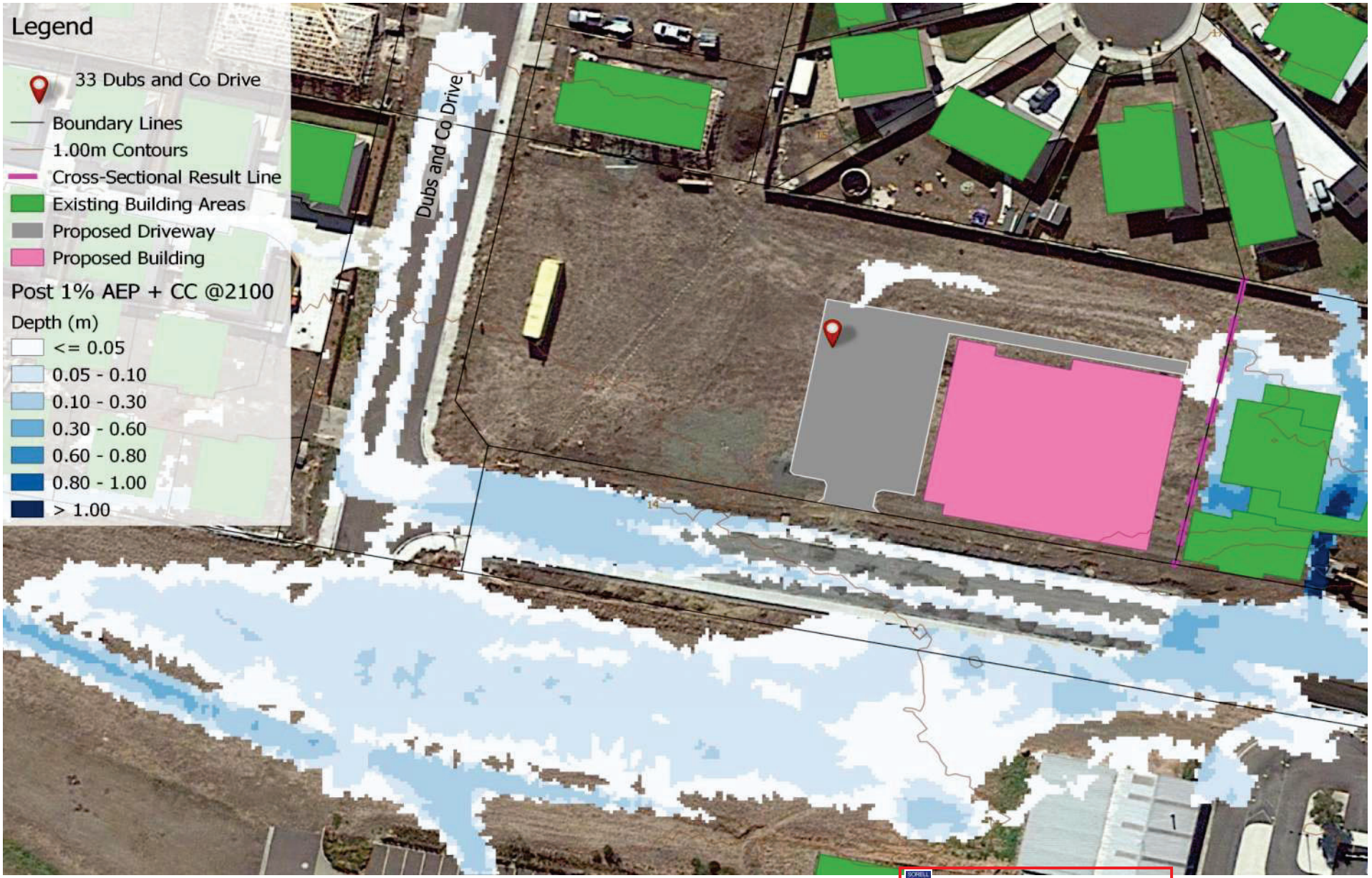

Figure 5. Post-Development 1% AEP + CC including Depth

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3.1 Displacement of Overland Flow on Third Party Property

Post-development flows in Figure 5 show that when compared against pre-development in Figure 4, there is only minimal increase in flood depths within the lot boundary, which is isolated to the carpark as the flood water follows the natural overland flow path to the western boundary of the lot.

This very minor increase in depths is due to the increase in impervious area following development and is contained within the lot boundaries therefore showing that the development does not have any effect on third party property.

3.1 Development Effects on Flooding

Below in Figure 6, is a hydrograph depicting the discharge at the southern property boundary for the overland flow originating from the development area. This graph was generated by the model for both the pre- and post-development models and is presented in graphical format to illustrate the changes in net discharge within the lot.

When comparing the pre- and post-development scenarios, we observe only minor alterations in discharge and velocity. The increase in impervious area resulting from the construction of the proposed dwelling leads to a slight rise in discharge, going from 0.021 m³/s to 0.023 m³/s, while velocity experiences a marginal decrease of 0.02 m/s from 0.22 m/s in the pre-development scenario.

Consequently, it's evident that the proposed dwelling does not elevate the risk level for surrounding properties, nor does it negatively impact public infrastructure.

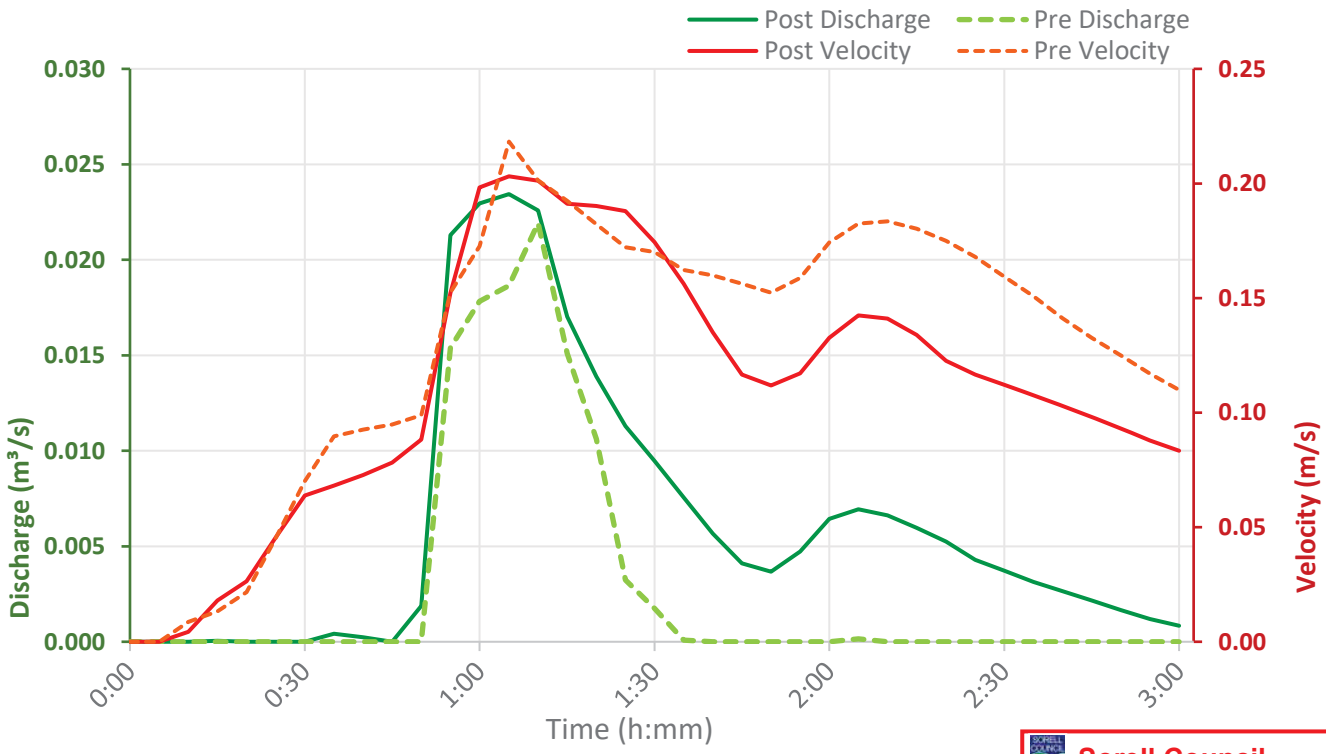

Figure 6. Pre and Post Development Net Discharge and Velocity 1% AEP +CC

3.2 New Habitable Building

To meet the performance criteria of the Building Regulations 2016 S.54, the construction of a new habitable building is required to have a habitable floor level >300mm above the >1% AEP + CC flood level. The new development at 33 Dubs and Co Drive, Sorell must meet this regulation as shown in Table 4. (The floor level >1% AEP + CC flood level + 300mm does not apply for non-habitable areas).

Table 4. Habitable Floor Construction Levels

33 Dubs and Co Drive, Sorell	1% AEP +CC flood level (mAHD)	Minimum Floor Level required (mAHD)	Proposed ground floor level (mAHD)
Habitable floor (ground floor)	14.45	14.75	15.00

A basement level is proposed in the design, which is to be utilised for storage, however, as this is not considered a habitable level, it is not required to meet the minimum floor level to comply with the Building Regulation S.54. As this basement level may be subject to inundation during a 1% AEP + CC event, to prevent damage, all structures should be subjected to a hydrostatic/hydrodynamic analysis to ensure suitability as advised by a suitably qualified structural engineer.

It is also a requirement that future use of the basement level must be in accordance with Building Regulations S.54 ensuring that minimum habitable floor levels stated in Table 4 are met.

4. Flood Hazard

Under existing conditions prior to development, the proposed location of the building is subject to be inundated to <0.084 m flood depth and <0.136 m/s velocity. This places the hazard rating as adopted by Australian Flood Resilience and Design Handbook as a maximum H1 – *Generally safe for people, vehicles and buildings* as shown in Appendix A – Hazard maps. The post-development scenario only sees the depth at the lot boundary increase by 0.023 m and the velocity decrease by 0.02 m/s. This has no effect on the hazard rating as the pre-development model is well within the lowest hazard band of H1.

As this study does not extend to the public access roads we cannot comment on the accessibility to the site, only within the site. Therefore, this report would advise that residents and visitors remain inside in the event of a flood unless instructed by emergency services.

A summary of the hazard ratings is shown in Figure 7.

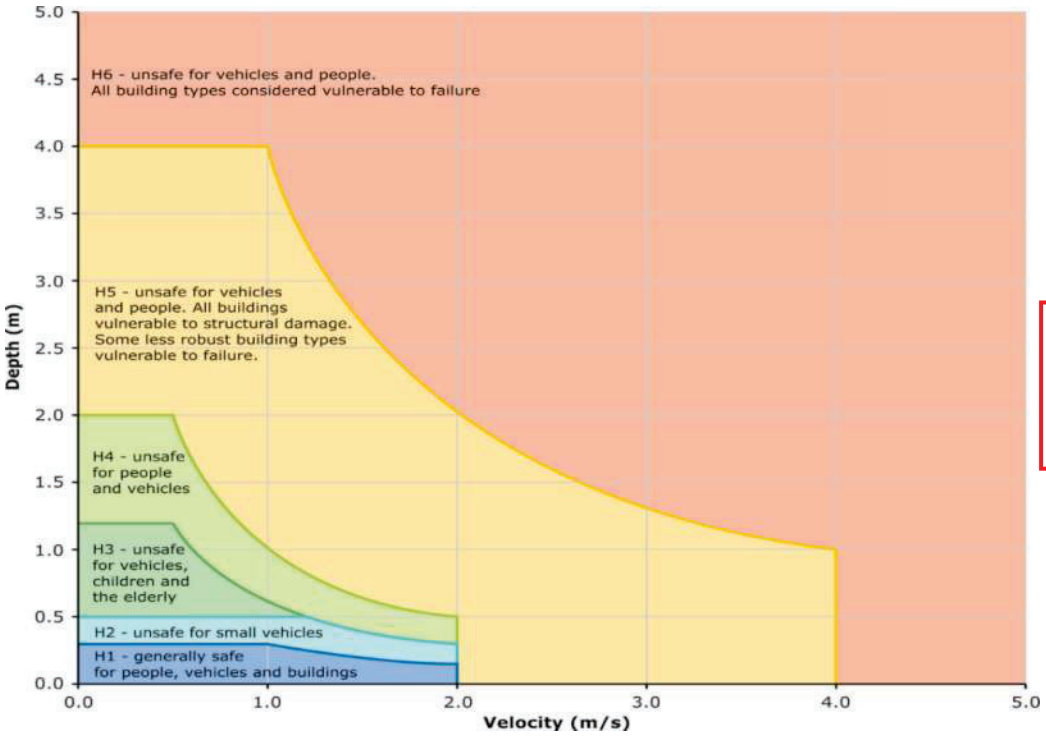

Figure 7. Hazard Categories Australian Disaster and Resilience Handbook

4.1 Tolerable Risk

The lot at 33 Dubs and Co Drive Sorell, is susceptible to a shallow, somewhat slow-moving flood plain flow, with the majority of the immediate surrounding region classified low (H1) hazard rating in the 1 % AEP + climate change event.

Even at minor velocity and depths during a storm event, erosion and debris movement nevertheless pose a threat. To ensure suitability, all structures should be subjected to a hydrostatic/hydrodynamic analysis. If the recommendations in this report are implemented, the proposed structure, which is intended to be a habitable possible class 4-9 structure with a 50-year asset life (BCA2019), can achieve a tolerable risk of flooding over its asset life.

5. TPS summary

Table 5. Tasmanian Planning Scheme summary C12.5.1

C12.5.1 Uses within a flood prone hazard area			
Objectives: That a habitable building can achieve and maintain a tolerable risk from flood			
Performance Criteria			
P1.1		**P1.1**	
A change of use that, converts a non-habitable building to a habitable building, or a use involving a new habitable room within an existing building, within a flood-prone hazard area must have a tolerable risk, having regard to:		Response from flood report	
(a)	the location of the building;	(a)	Proposed dwelling lies inside a low hazard flood inundation area.
(b)	the advice in a flood hazard report;	(b)	Assuming recommendations of this report are implemented, no additional flood protection measures required for the life expectancy of the building.
(c)	any advice from a state authority, regulated entity or a council;	(c)	N/A
P1.2		**P1.2**	
A flood hazard report also demonstrates that:		Response from flood report	
(a)	any increase in the level of risk from flood does not require any specific hazard reduction or protection measures;	(a)	No increase in level of risk from pre-development scenario.
(b)	the use can achieve and maintain a tolerable risk from a 1% annual exceedance probability flood event for the intended life of the use without requiring any flood protection measures	(b)	Maximum hazard rating at the proposed development is at H1.

Table 6. Tasmanian Planning Scheme summary C12.6.1

C12.6.1 Building and works within a flood prone area			
Objective: (a) building and works within a flood-prone hazard area can achieve and maintain a tolerable risk from flood; and, (b) buildings and works do not increase the risk from flood to adjacent land and public infrastructure.			
Performance Criteria			
P1.1		**P1.1**	
Buildings and works within a flood-prone hazard area must achieve and maintain a tolerable risk from a flood, having regard to:		Response from flood report	
(a)	the type, form, scale and intended duration of the development;	(a)	Proposed dwelling.
(b)	whether any increase in the level of risk from flood requires any specific hazard reduction or protection measures;	(b)	No increase in risk following construction of the building requiring specific hazard reduction measures.
(c)	any advice from a State authority, regulated entity or a council; and	(c)	N/A
(d)	the advice contained in a flood hazard report.	(d)	Flood report and recommendations provided within.
Performance Criteria			
P1.2		**P1.2**	
A flood hazard report also demonstrates that the building and works:		Response from Flood Report	
(a)	do not cause or contribute to flood on the site, on adjacent land or public infrastructure; and	(a)	Negligible changes to flow and velocity following construction of proposed building.
(b)	can achieve and maintain a tolerable risk from a 1% annual exceedance probability flood event for the intended life of the use without requiring any flood protection measures.	(b)	Assuming recommendations of this report the proposed site and dwellings can achieve a tolerable risk to the 1% AEP storm event for the life expectancy of the building.

6. Conclusion

The Flood Hazard Report for 33 Dubs and Co Drive, Sorell development site has reviewed the potential development flood scenario.

The following conclusions were derived in this report:

1. A comparison of the post-development peak flows for the 1% AEP at 2100 were undertaken against Code C12.5.1 and C12.6.1 of the Tasmanian Planning Scheme.
2. Building Regulations S.54 requires a floor level of no less than the levels outlined in Table 4.
3. Negligible changes in depth at the property boundary. Increase in depth within the lot to 0.003 – 0.01 m near the northern property boundary.
4. Peak discharge sees a 0.02 m^3/s increase from pre- to post-development, riverine flood scenarios.
5. Velocity shows a decrease between pre- and post-development, riverine flood scenarios.
6. Hazard from flooding within the lot remain at the majority category of H1 for both pre and post development riverine and coastal hazard flood scenarios on neighbouring properties.

7. Recommendations

Flüssig Engineers therefore recommends the following engineering design be adopted for the development and future use to ensure the works meets the Inundation Code:

1. The new building to have a minimum floor height as per Table 4 (Floor level =14.75mAHD).
2. Proposed structures, located in the inundation area, are to be designed to resist flood forces including debris to a maximum depth of 100mm and maximum velocity of 0.3 m/s at a NE flow direction.
3. Carpark must be graded 1% minimum towards the north-western boundary and away from the building.
4. All future proposed structures within the flood extent not shown within this report will require a separate design and report addressing their impacts.

Under the requirements of this Flood Hazard Report, the proposed development will meet current acceptable solutions and performance criteria under the Tasmanian Planning Scheme 2021.

8. Limitations

Flüssig Engineers were engaged by **Julfan Pty Ltd** on behalf of the developer**,** for the purpose of a site-specific Flood Hazard Report for 33 Dubs and Co Drive, Sorell, in response to the Tasmanian Planning Scheme 2021. This study is deemed suitable for purpose at the time of undertaking the study. If the conditions of the site should change, the report will need to be reviewed against all changes.

This report is to be used in full and may not be used in part to support any other objective other than what has been outlined within, unless specific written approval to do otherwise is granted by Flüssig Engineers.

Flüssig Engineers accepts no responsibility for the accuracy of third-party documents supplied for the purpose of this Flood Hazard Report.

9. References

1. Australian Disaster Resilience Guideline 7-3: Technical flood risk management guideline: Flood hazard, 2014, Australian Institute for Disaster Resilience CC BY-NC
2. Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia
3. Entura, 2019, Sorell Rivulet Flood Study
4. Grose, M. R., Barnes-Keoghan, I., Corney, S. P., White, C. J., Holz, G. K., Bennett, J. & Bindoff, N. L. (2010). Climate Futures for Tasmania: General Climate Impacts Technical Report.
5. T.A. Remenyi, N. Earl, P.T. Love, D.A. Rollins, R.M.B. Harris, 2020, Climate Change Information for Decision Making –Climate Futures Programme, Discipline of Geography & Spatial Sciences, University of Tasmania.

Appendices

Appendix A Flood Study Maps

PRE 1% AEP + CC @2100

Legend

33 Dubs and Co Drive

Boundary Lines

1.00m Contours

Existing Building Areas

Pre 1% AEP + CC @2100

Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1.00

Sorell Council

Development Application: 33 Dubs and Co Drive, Sorell

Plans Reference: P1

Date Received: 02/01/2024

0 10 20 m

meters

N

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- 21-11-2023 - Flussig Engineers

Map CRS: GDA94 / MGA zone 55 EPSG:28355

PRE 1% AEP + CC @2100

Legend

33 Dubs and Co Drive

Boundary Lines

Existing Building Areas

Pre 1% AEP + CC @2100

Velocity (m/s)

- <= 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

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0 10 20 m

meters

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PRE 1% AEP + CC @2100

Legend

33 Dubs and Co Drive

Boundary Lines

Existing Building Areas

Pre 1% AEP + CC @2100

Hazard

- H1
- H2
- H3
- H4
- H5
- H6

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0 10 20 m

meters

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POST 1% AEP + CC @2100

Legend

- 33 Dubs and Co Drive
- 1.00m Contours
- Boundary Lines
- Existing Building Areas
- Proposed Building
- Proposed Driveway

Post 1% AEP + CC @2100

Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1.00

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0 10 20 m

meters

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POST 1% AEP + CC @2100

Legend

33 Dubs and Co Drive

Boundary Lines

Existing Building Areas

Proposed Building

Proposed Driveway

Post 1% AEP + CC @2100

Velocity (m/s)

<= 0.50

0.50 - 1.00

1.00 - 1.50

1.50 - 2.00

> 2.00

Sorell Council

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0 10 20 m

meters

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POST 1% AEP + CC @2100

Legend

- 33 Dubs and Co Drive
- Boundary Lines
- Existing Building Areas
- Proposed Building
- Proposed Driveway

Post 1% AEP + CC @2100

Hazard

- H1
- H2
- H3
- H4
- H5
- H6

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0 10 20 m

meters

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TRAFFIC IMPACT ASSESSMENT

OFFICE FACILITY

33 DUBS AND CO DRIVE, SORELL

Hubble Traffic

December 2023

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Version	Date	Reason for Issue
Draft	December 2023	Draft issued for client feedback

Table of Contents

1. Introduction

Frank Morgan (developer) has engaged Hubble Traffic to prepare an independent Traffic Impact Assessment, to consider the traffic impacts from the provision of a new office facility located at Lot 2, 33 Dubs and Co Drive, Sorell.

The development has been assessed against the Tasmanian Planning Scheme C2 Parking and Sustainable Transport Code, C3 Road and Railway Assets Code, and the Australian Standard 2890.1:2004.

This report has been prepared to satisfy the requirements of Austroads, Guide to Traffic Management Part 12: Traffic Impacts of Developments, 2019, and has referred to the following information and resources:

- Tasmanian Planning Scheme, (Sorell Council)
- Road Traffic Authority NSW (RTA) Guide to Traffic Generating Developments
- Australian Standards AS2890 parts 1, 2 and 6
- Austroads series of Traffic Management and Road Design
  - Part 4: Intersection and crossings, General
  - Part 4a: Unsignalised and Signalised Intersections
  - Part 12: Traffic Impacts of Development
- Department of State Growth
- LIST Land Information Database

2. Site Description

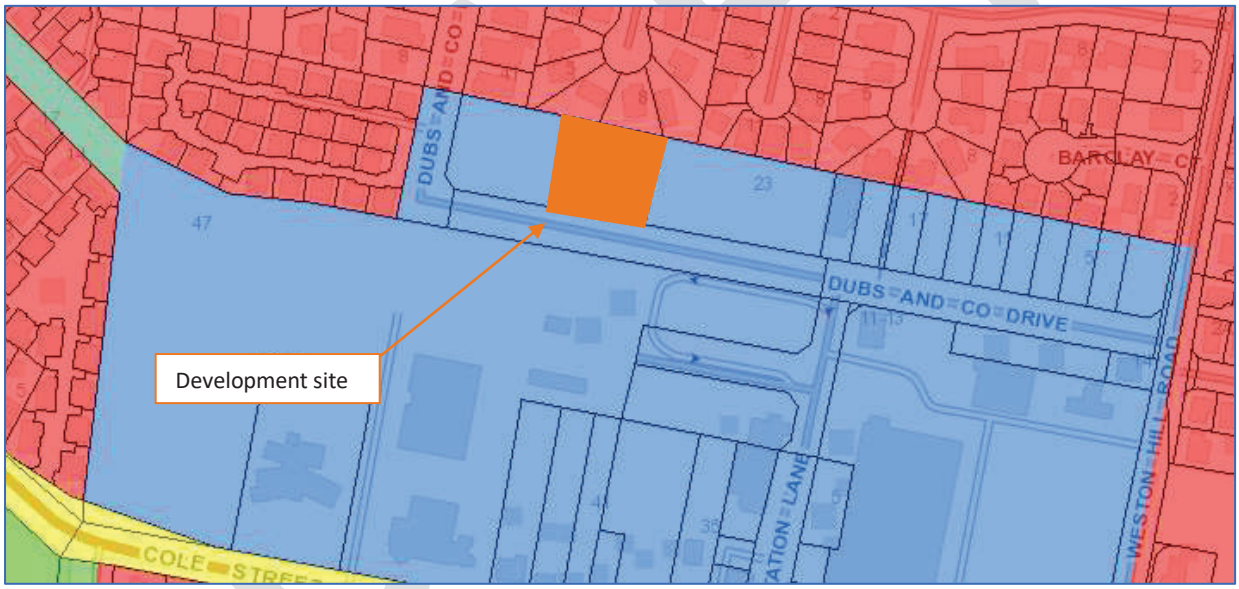
The development site is located at lot 2, 33 Dubs and Co Drive, Sorell, and is an undeveloped large parcel of land, situated on a mostly flat terrain. The site has an existing concrete vehicular access with Dubs and Co Drive.

According to LIST database, the site is located within a General Business zone, adjacent to the Discovery Early Learning Centre (Childcare centre), close proximity to the Gateway Shopping Centre, and opposite a public transport facility (park and ride).

Both sides of Dubs and Co Drive is zoned as General Business, while the land to the north and east is zoned general residential, which means the development site can take advantage of clients walking to the facility, using public transport, or sharing established car parking facilities.

Currently along the northern side of Dubs and Co Drive there are two established commercial businesses, the Childcare centre, and Salvation Army Store, with the remaining land undeveloped.

Diagram 2.0 – Extract from LIST Land Information Database



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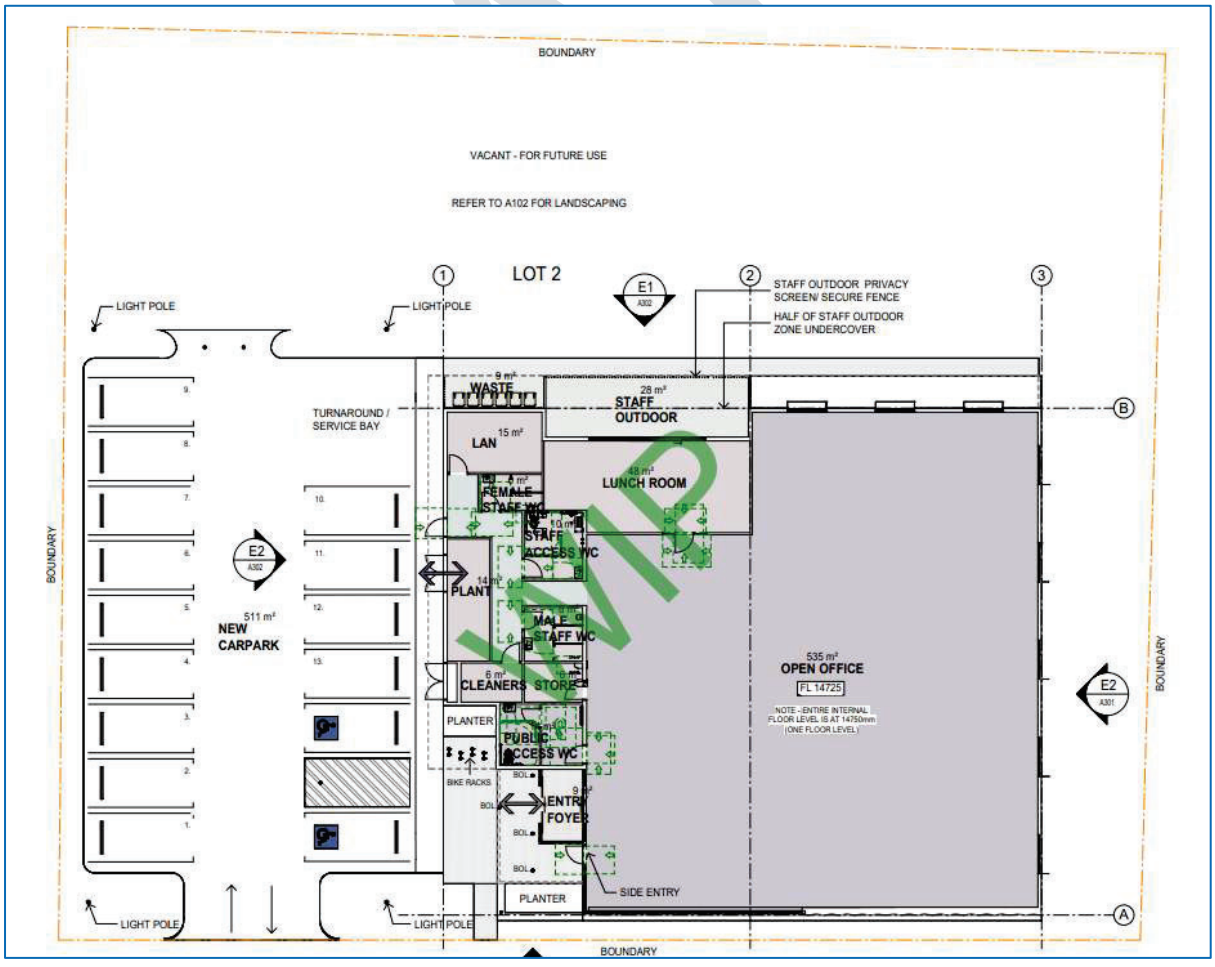
3. Development proposal

The development proposal is for an office facility, suitable for providing government service. The building will be a single storey with 535 square metres of office space, supported with 205 square metres of amenities, and 15 on-site car parking spaces.

It is expected that the office facility will operate between 8:30am and 4:30pm, Monday to Friday, with 10 to 15 employees on site at any one time. The service is expected to generate clients to the site, and this assessment estimates between 16 and 20 clients within an hour period, with the majority of clients required to make an appointment before arriving, to minimise client wait times.

The architectural plans prepared by X-Square indicates the building will be situated on the eastern side of the lot, significantly set-back from the rear boundary, with this rear land available for future development and overflow car parking if necessary. The formed car parking area located on the western side will operate from a single two-way vehicular access. The development is located on the northern side of Dubs and Co Drive, and directly outside of the building there will be 45 metres of on-street parking.

Diagram 3.0 – Proposed development layout



4. Trip generation by this development

A trip in this report is defined as a one way vehicular movement from one point to another excluding the return journey. Therefore, a return trip to and from a land use is counted as two trips.

The number of employees and number of clients expected to be seen in a day, will be used to determine the likely number of trips generated.

- A maximum of 15 employees will be on-site per day, and as a worst case scenario it will be assumed all employees will arrive on-site by private vehicle and will generate a separate trip during the morning and evening peak periods.
- Operational hours are expected to be between 8:30am and 4:30pm, with services likely to accommodate up to 20 clients within any one hour period, with a maximum of 160 clients seen in a single day.
- It is assumed the facility will begin and finish within the peak hour traffic periods.

As a worst case scenario, the facility has the potential to generate 358 daily vehicle trips, without discounting employees and clients arriving by alternative transport modes, such as public transport, walking, and cycling. Use of alternative transport modes is likely, as the site is within a commercial precinct, in close proximity to a public transport hub, and to established residential areas.

Based on the above assumptions, this development has the potential to generate 55 two-way trips on the surrounding local road network, in the morning and evening peak hour periods.

Table 4.0 – Predicted trip generation (worst case scenario)

Trip generator	Number per weekday	Number of trips during the morning peak	Number of trips during the evening peak	Number of trips between peaks	Total weekday trips
Staff	15	15	15	8	38
Clients	160	40	40	260	320
Total	**175**	**55**	**55**	**268**	**358**

In comparison, the RTA Guide to Traffic Generating Development (RTA Guide), specifies that a commercial premise is likely to generate 10 trips per 100m^2 of gross floor area, with two trips per 100 m^2 of gross floor area in the evening peak hour. For this development this would equate to 74 daily trips, with 15 peak hour trips.

The RTA Guide indicates mode split has impact to traffic generation rates, and public sector offices often generate higher traffic densities.

The predicted trip generation as detailed in table 4, is considered appropriate and will be used within this traffic assessment to assess a worst case scenario.

5. Existing surrounding road network

Dubs and Co Drive within the surrounding road network would act as a local access road, providing access to the local businesses, while also providing a connection to the established urban residential area. The nearest arterial road is Cole Street, with Station Lane providing connection between the two roads. With the intersection of Station Lane and Cole Street controlled by traffic signals, it would be the preferred route for vehicles accessing the development site.

5.1. Dubs and Co Drive characteristics

Dubs and Co Drive runs in an east to west orientation, extending between Weston Hill Road and Pennington Drive, with Station Lane intersecting midway. Adjacent to the development site the road has a straight horizontal alignment, with a sharp right hand bend west of the site, and relatively flat vertical grade.

The road has been built to a typical urban standard, with sealed bitumen surface measuring nine metres wide between kerb faces, concrete kerb and guttering, with 1.5 metre wide footpaths along both sides, and street lighting. The road complies with the LGAT standards, ensuring there is sufficient width to allow for on-street parking, while maintaining efficient traffic flow.

Photograph 5.1 – Dubs and Co Drive standard

5.2. Speed limit

With no posted speed limit on Dubs and Co Drive, the default 50 km/h urban speed limit would apply.

5.3. Traffic activity on the surrounding road network

To evaluate the traffic impact from the development, it is important to understand the current traffic flow on the surrounding road network. Recent manual traffic surveys were undertaken to capture traffic using Dubs and Co Drive and Station Lane junction, as Station Lane connects to the nearest main arterial road (Cole Street). The surveys were conducted during the peak hour periods that coincided with the office developments operational hours.

- Significant traffic generators

  The surveys found two significant traffic generators in the immediate vicinity of the development site:

  - Childcare Centre -This facility generated 64 two-way vehicle movements in the morning peak hour, and 75 in the evening, with the majority of vehicles using the Station Lane junction, which reduces the two-way flow travelling past the development site.
  - Park and Ride - This facility has a separate entry and exit onto Station Lane for light vehicles, and a bus access from Dubs and Co Drive situated directly opposite the Childcare Centre, with bus movements not passing the development site. In the morning peak hour, the park and ride generated 41 two-way light vehicle movements, and six buses. In the evening this facility generated 26 light vehicle movements and five buses.

- Other modal transport observations

  In the morning peak hour, eight pedestrians were observed crossing from the park and ride facility into the Childcare Centre, assumed to be employees, using the public transport service or the park and ride parking spaces. In the evening three employees from the Childcare Centre crossed to the park and ride, with two collecting parked vehicles and one using the public transport services.

The surveys captured 50 two-way vehicle movements travelling past the development site in the morning and 82 in the evening, with diagram 5.2A and 5.2B providing the peak hour traffic flows.

Diagram 5.3A – Current morning peak hour traffic flows (7:30am to 8:30am)

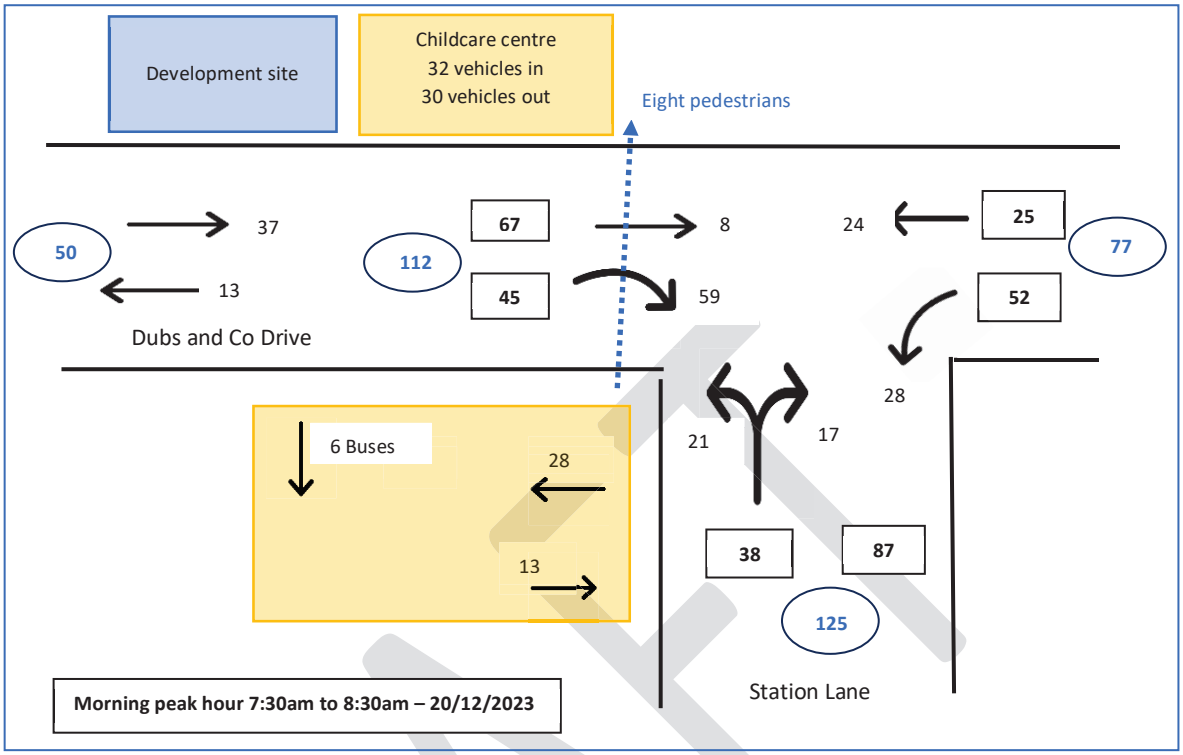
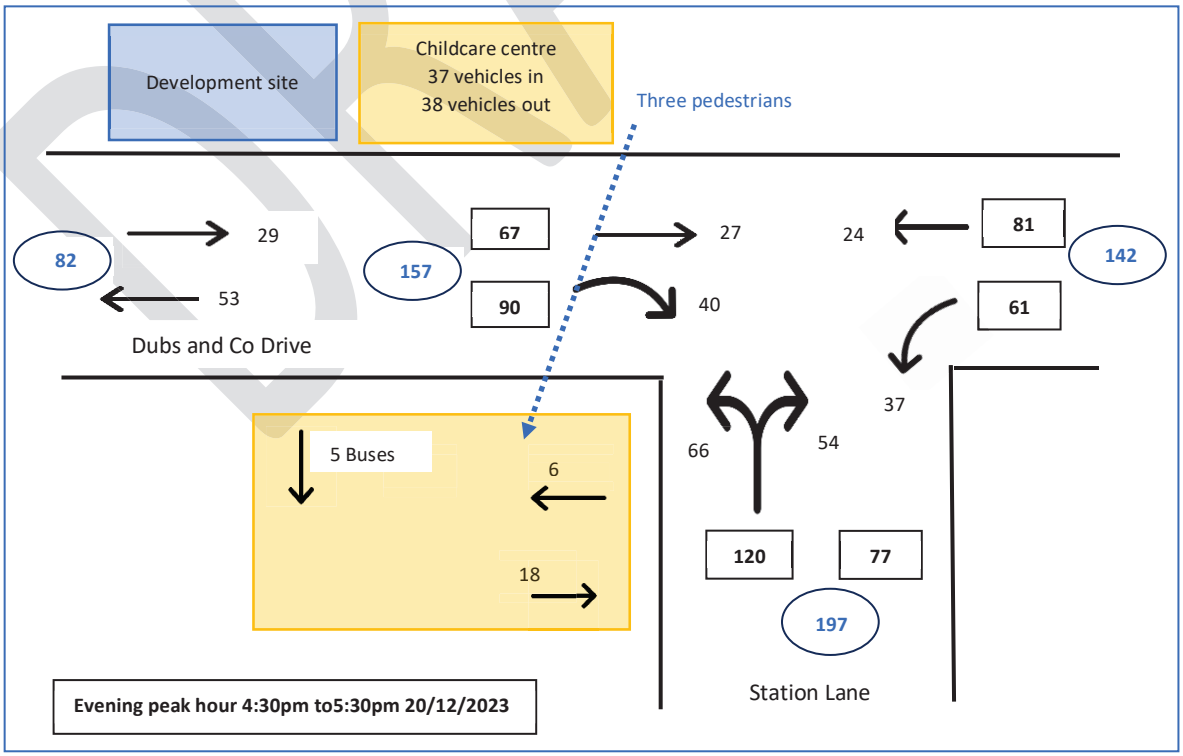


Diagram 5.3B – Current evening traffic flows (4:00pm to 5:00pm)



6. Impact from traffic generated by this development

As indicated in section 4 of this report, the development is predicted to generate 358 daily vehicle trips, and of these trips, 55 are likely to occur during the morning and evening peak hour periods.

6.1. Lane capacity and level of service of the surrounding road network

The traffic performance of urban roads can be assessed using directional peak hour traffic flows, with the RTA Guide providing a table of level of service (LOS), as shown in extract 6.1. For the surrounding local road network, there is one traffic lane in each direction, which means that a directional hourly flow of under 200 vehicles per hour, which represents the highest level of traffic performance, at LOS A.

Extract 6.1 – RTA Guide for urban roads

Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

The additional 55 trips generated from the development site have been assigned to the surrounding road network, based on 95 percent of the trips using Station Lane. Table 6.1 compares the level of service between the current traffic conditions and when the development is operating. It demonstrates that the surrounding road network has sufficient spare traffic capacity, and the increase in traffic will not cause a deterioration in traffic efficiency, as users will continue to receive the highest level of service LOS A.

Table 6.1 – Comparison of lane capacity with the development operating

Road	Criteria	Current traffic conditions				Traffic conditions with development			
		Morning peak		Evening peak		Morning peak		Evening peak	
		EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB
Dubs and Co Drive	Flow	67	45	67	90	86	79	101	109
	LOS	A	A	A	A	A	A	A	A
Station Lane	Flow	38	87	120	77	72	106	139	111
	LOS	A	A	A	A	A	A	A	A

6.2. Traffic efficiency and impact at Dubs and Co Drive and Station Lane junction

The simplest method to determine the traffic performance at a junction is to use SIDRA Intersection traffic modelling software, which uses gap acceptance theory to determine the average delay, queue lengths and degree of saturation, which are all measures of traffic congestion and level of service.

Level of Service (LOS) is a quantifiable assessment of the factors that contribute to the traffic performance, which includes traffic density, gaps in traffic streams, expected delays, and queues. For junctions, there are five levels from A to E, with A providing the highest level for give-way controlled junctions, meaning motorists are not incurring delays, with ample gaps in the traffic stream for vehicles to turn freely and safely without disrupting other users. The following table provides a reference to the level of service for the various traffic controls.

Diagram 6.2 – RTA Level of service for intersections

Table 4.2
Level of service criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode

Additional traffic generated from the development was assigned to the surrounding road network, with the table below quantifying the traffic impact. Traffic modelling indicates the junction is lightly trafficked, as Degree of Saturation (DOS) indicates the junction is operating at four percent of its capacity in the morning and five percent in the evening. Table 6.2 demonstrates that the additional development traffic will not cause a reduction in traffic performance, and the junction will continue to operate at LOS A.

Table 6.2 – Comparison of traffic modelling between existing and with development operating

Period	Scenario	Total vehicles	DOS	Worst average delay	LOS	Max queue
Morning peak hour	Existing	165	0.041	5.8 secs	A	1.3 metres
	Development	221	0.053	5.9 secs	A	1.7 metres
Evening peak hour	Existing	261	0.094	5.9 secs	A	2.6 metres
	Development	317	0.109	6 secs	A	3.1 metres

Printout of the modelling results is available in appendix A.

7. Access arrangement to the development site

7.1. Vehicular access

The existing six metre wide concrete vehicular access with Dubs and Co Road is suitable to accommodate two-way traffic flow and will be retained. This access has a gentle vertical incline leading into the site, which is not expected to adversely impact vehicles entering and leaving.

Photograph 7.1 – Existing vehicular access with Dubs and Co Drive

7.2. Sight distance at existing vehicular access

It is important that drivers leaving the development site have suitable sight distance to undertake turning manoeuvres in a safe manner, without impacting motorists travelling along Dubs and Co Drive.

Safe Intersection Sight Distance (SISD) is the optimum distance to enable a vehicle leaving the development site, to see approaching vehicles, and then have sufficient time to enter the road without impacting the approaching vehicles, meaning that vehicles do not need to slow. SISD is based on the operating speed of approaching vehicles and the gradient of the approaching road.

Austroads Guide to Road Design (AGRD) indicates that adequate sight distance is based on the prevailing operating speed of approaching vehicles. As Dubs and Co Drive has a default 50 km/h speed limit, a straight road alignment, and flat gradient, the AGRD table 3.2 requires a SISD of 90 metres, based on a driver reaction time of 1.5 seconds.

Available sight distance was measured on-site, based on a driver positioned 1.05 metres above the road surface, with an approaching vehicle being 1.2 metres high, and measured 90 metres to the right and in excess of 100 metres to the left.

This assessment has determined that there is sufficient sight distance available for the prevailing operating speed of approaching vehicles, meaning vehicles will be able to leave the development site in a safe and efficient manner, without impacting other road users. The available sight distance is shown in the following two photographs.

Photograph 7.2A – Available sight distance to the left

Photograph 7.2B – Available sight distance to the right

8. On-site parking and internal road layout

8.1. Number of car parking spaces

Planning scheme table C2.1 prescribes the number of on-site parking spaces required based on the type of land use. The development fits within Business and Professional Services land use (Office use), which requires one space per 40 square metres of floor area.

Based on the information provided by the developer, the facility will have an office floor area of 535 square metres, with 13 on-site car parking spaces to be provided. The development will provide 15 on-site parking spaces to meet the reasonable demand to eliminate parking overflow, which will comply with the planning scheme acceptable solution.

8.2. Dimensions of parking spaces

The car parking spaces will be designed to comply with the planning scheme parking dimensions in table C2.3, where ninety-degree parking spaces will be a minimum 2.6 metres wide, 5.4 metres long, and supported with a minimum 6.4 metre manoeuvring area or access aisle.

All car parking spaces have been designed to be situated on a gradient less than five percent, in both longitudinal and transverse directions, supported with wheel stops and delineated with line markings.

8.3. Internal road layout and gradients

The design incorporates a main internal driveway that will be a minimum of 5.5 metres, to facilitate safe and efficient two-way traffic movements. At the end of the driveway on the eastern side is a turnaround bay, to ensure all vehicles can enter and leave the site in a forward-driving direction.

Although civil plans have not been provided by the client, the development is located on flat terrain and the vertical gradients of the internal driveway are not expected to cause any adverse impact to vehicles.

8.4. Internal pedestrian pathways

An internal pedestrian pathway will be provided to connect the main entrance to the on-site parking spaces and existing footpath on Dubs and Co Drive. The pathway will be a minimum of one metre wide, constructed with concrete and separated from the internal driveway by kerbing or wheel stops where possible.

Overall, pedestrians will be provided with good level of service.

8.5. Other parking requirements

Bicycle parking spaces

Planning scheme table C2.1 prescribes the amount of on-site bicycle parking spaces required based on the type of land use. For an Office use, the requirement is one space per 500 square metres of floor area. Based on the facility having an office floor area of 535 square metres, one on-site bicycle parking space is required. Four on-site bicycle parking spaces will be provided within close proximity to the main entrance, which exceeds the requirement under the planning scheme.

Motorcycle parking spaces

Planning scheme table C2.4 prescribes the number of motorcycle parking spaces required, based on the number of car parking spaces being provided. The development site is required to provide 13 on-site car parking spaces, with no motorcycle parking spaces required.

Accessible parking spaces

Two dedicated accessible parking spaces will be provided and located as close as possible to the buildings entrance.

8.6. Turning facility and waste collection area

A turning bay is included in the car park layout, to allow for all vehicles to enter and leave the development site in a forward-driving direction.

The turning bay is located adjacent to the waste collection area, which will allow for a standard waste collection vehicle to reverse into the car park to collect the waste material. The reversing manoeuvre is not expected to cause adverse safety or traffic impact, as the collection can be scheduled to occur outside of the operational hours, the vehicles have reversing cameras, the drivers are professional drivers, and activity is infrequent.

9. Planning scheme

9.1. C2.0 Parking and Sustainable Transport Code

C2.5.1 Car parking numbers

Fifteen on-site car parking spaces will be provided, exceeding the planning scheme acceptable solution, and minimising the risk of overflow parking.

C2.5.2 Bicycle parking numbers

A total of four bicycle parking spaces will be provided, exceeding the planning schemes acceptable solution.

C2.5.3 Motorcycle parking numbers

With the development site required to only provide 13 on-site car parking spaces, table C2.4 of the planning scheme prescribes no dedicated motorcycle parking space is required.

C2.5.4 Loading bays

Not applicable for this type of development.

C2.6. Development standards

C2.6.1 Construction of parking areas.	The parking areas and driveways will be constructed with an asphalt surface and supported with appropriate kerbing to collect and direct surface water to an approved stormwater drainage system. The design complies with the acceptable solution A1.
C2.6.2 Design and layout of parking areas.	Car parking spaces have been designed to comply with the dimensions specified in planning scheme table C2.3, with the parking spaces having suitable manoeuvring area to enable vehicles to enter and leave efficiently. Two accessible parking spaces will be provided as close to the entrance of the building as possible and will be designed to comply with the Standard AS/NZS 2890.6:2009 Parking facilities, Off-street parking for people with disabilities. The driveway will accommodate two-way traffic movements and include a turning bay to allow for all vehicles to enter and leave in a forward-driving direction. The parking spaces will be delineated by line markings, supported with wheel stops and situated on compliant gradients. The parking layout complies with the acceptable solution A1.1 and A1.2 under the planning scheme.

C2.6.3 Number of accesses for vehicles.	The existing six metre wide vehicular access with Dubs and Co Drive will be retained, which is suitable to accommodate two-way traffic movements, and complies with the acceptable solution A1 (a) and (b).
C2.6.4 Lighting of parking areas within the general business zone and central business zone	The car parking spaces, and pedestrian pathway will be lit to the appropriate standards, complying with the acceptable solution.
C2.6.5 Pedestrian access.	A minimum one metre wide internal pedestrian pathway will be provided, connecting the main entrance of the building with the parking spaces and existing footpath along Dubs and Co Drive. The pathway will be separated from the driveway by kerbing or wheel stops where possible, complying with the acceptable solution.
C2.6.6 Loading bays.	Not applicable for this type of development.
C2.6.7 Bicycle parking and storage facilities	Wheel frames will be provided to accommodate four bicycles and will be located at the front entrance.
C2.6.8 Siting of parking and turning areas.	The parking spaces and vehicle turning areas will be located adjacent to the building, landscaping will be included, and the parking spaces are not expected to cause any unreasonable visual impact on the streetscape, or loss of amenity to adjoining properties.

9.2. C3.5.1 Traffic generation at a vehicle crossing, level crossing or new junction

The development will increase the number of daily vehicle movements by more than 20 percent or 40 vehicle movements per day and will need to be assessed against the performance criteria P1, to ensure the access can operate safely and efficiently.

Performance criteria	Assessment
Vehicular traffic to and from the site must minimise any adverse effects on the safety of a junction, vehicle crossing or level crossing or safety or efficiency of the road or rail network, having regard to:	
a) Any increase in traffic caused by the use;	The development site is estimated to generate 358 daily trips, with 55 of these occurring during the peak hour periods.
b) The nature of the traffic generated by the use;	The development is expected to generate light vehicles, less than 5.5 metres in length, which are compatible with the existing vehicles using the surrounding local road network.
c) The nature of the road	Dubs and Co Drive is a local access road, constructed to an urban standard, with sufficient road width to accommodate two-way traffic movements, while supporting kerbside parking. The road standard is suitable to accommodate additional traffic movements. There is sufficient sight distance at the existing vehicular access to enable vehicles to enter and leave the site in a safe and efficient manner, without impacting other users.
d) The speed limit and traffic flow of the road	There is no posted speed limit on Dubs and Co Drive, with the default urban 50 km/h speed limit applying. Recent traffic surveys determined the surrounding road network is lightly trafficked. Traffic analysis demonstrated there is sufficient spare traffic capacity to accommodate the increase in traffic generated by the development, without causing adverse impact or deterioration in traffic performance. Traffic modelling demonstrated that Station Lane junction has sufficient spare traffic capacity to absorb the increase in traffic, without causing adverse impact, the junction will continue to provide motorists with the highest level of traffic efficiency. The modelling determined once the development is operating there is sufficient spare traffic capacity to accommodate future traffic growth, as the junction is predicted to operate at less than ten percent of the junction traffic capacity.
e) Any alternative access to a road	None.
f) The need for the use	A purpose built office facility suitable for a government service will provide better service to clients within the local area.
g) Any traffic impact assessment	A traffic impact assessment found no reason for this development not to proceed.
h) Any advice received from the rail or road authority	Aware of none.

10. Conclusions

From a traffic engineering and road safety perspective, additional traffic generated from this development is not expected to create any adverse safety, amenity, or traffic efficiency problems, as:

- traffic generated by this development will not impact the current level of service motorists are receiving, with sufficient capacity within the current road network to absorb the extra traffic movements,
- the existing access can provide for safe and efficient access to the public road network,
- sufficient on-site parking spaces will be provided to meet the expected demand, and prevent overflow parking occurring outside of the site,
- all vehicles will enter and leave the development site in a forward-driving direction.

This Traffic Impact Assessment found no reason for this development not to proceed.

11. Appendix A – Traffic modelling

Morning peak hour – Existing traffic flow

MOVEMENT SUMMARY

Site: 101 [Dubs and Co Drive - current morning]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Station Lane								
1	L2	22	10.0	0.030	5.7	LOS A	0.1	0.8
3	R2	18	0.0	0.030	5.8	LOS A	0.1	0.8
Approach		40	5.5	0.030	5.8	LOS A	0.1	0.8
East: Dubs and Co Drive								
4	L2	29	0.0	0.029	5.5	LOS A	0.0	0.0
5	T1	25	0.0	0.029	0.0	LOS A	0.0	0.0
Approach		55	0.0	0.029	3.0	NA	0.0	0.0
West: Dubs and Co Drive								
11	T1	8	0.0	0.041	0.2	LOS A	0.2	1.3
12	R2	62	0.0	0.041	5.6	LOS A	0.2	1.3
Approach		71	0.0	0.041	4.9	NA	0.2	1.3
All Vehicles		165	1.3	0.041	4.5	NA	0.2	1.3

Morning peak hour – Traffic performance with development traffic

MOVEMENT SUMMARY

Site: 101 [Dubs and Co Drive - current morning with development]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Station Lane								
1	L2	58	10.0	0.053	5.7	LOS A	0.2	1.5
3	R2	18	0.0	0.053	5.9	LOS A	0.2	1.5
Approach		76	7.6	0.053	5.8	LOS A	0.2	1.5
East: Dubs and Co Drive								
4	L2	29	0.0	0.029	5.5	LOS A	0.0	0.0
5	T1	25	0.0	0.029	0.0	LOS A	0.0	0.0
Approach		55	0.0	0.029	3.0	NA	0.0	0.0
West: Dubs and Co Drive								
11	T1	8	0.0	0.052	0.2	LOS A	0.2	1.7
12	R2	82	0.0	0.052	5.6	LOS A	0.2	1.7
Approach		91	0.0	0.052	5.1	NA	0.2	1.7
All Vehicles		221	2.6	0.053	4.8	NA	0.2	1.7

Evening peak hour - Existing traffic flow

MOVEMENT SUMMARY

Site: 101 [Dubs and Co Drive - current evening]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Station Lane								
1	L2	69	10.0	0.094	5.7	LOS A	0.4	2.6
3	R2	57	0.0	0.094	5.9	LOS A	0.4	2.6
Approach		126	5.5	0.094	5.8	LOS A	0.4	2.6
East: Dubs and Co Drive								
4	L2	39	0.0	0.034	5.5	LOS A	0.0	0.0
5	T1	25	0.0	0.034	0.0	LOS A	0.0	0.0
Approach		64	0.0	0.034	3.4	NA	0.0	0.0
West: Dubs and Co Drive								
11	T1	28	0.0	0.040	0.2	LOS A	0.2	1.2
12	R2	42	0.0	0.040	5.6	LOS A	0.2	1.2
Approach		71	0.0	0.040	3.4	NA	0.2	1.2
All Vehicles		261	2.7	0.094	4.6	NA	0.4	2.6

Evening peak hour – Traffic performance with development traffic

MOVEMENT SUMMARY

Site: 101 [Dubs and Co Drive - current evening with development]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Station Lane								
1	L2	89	10.0	0.109	5.7	LOS A	0.4	3.1
3	R2	57	0.0	0.109	6.0	LOS A	0.4	3.1
Approach		146	6.1	0.109	5.8	LOS A	0.4	3.1
East: Dubs and Co Drive								
4	L2	39	0.0	0.034	5.5	LOS A	0.0	0.0
5	T1	25	0.0	0.034	0.0	LOS A	0.0	0.0
Approach		64	0.0	0.034	3.4	NA	0.0	0.0
West: Dubs and Co Drive								
11	T1	28	0.0	0.061	0.2	LOS A	0.3	2.0
12	R2	78	0.0	0.061	5.6	LOS A	0.3	2.0
Approach		106	0.0	0.061	4.2	NA	0.3	2.0
All Vehicles		317	2.8	0.109	4.8	NA	0.4	3.1